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Original communication

Study of poisoning trends in north India – A perspective in relation to world statistics

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ABSTRACT

India is an agriculture based country with Punjab as one of the leading food grain producing states. There is an ever increasing burden to feed the growing population. This has led to over-usage of pesticides which on one hand has contributed significantly to increase the crop yield while on the other hand has led to sharp increase in the poisoning cases in the region. The present study was undertaken to study the deaths related to poisoning in Malwa region of Punjab in 2010 with a view to assess the pattern, trends and incidence of poisoning in relation to age, sex, area, season and type of poison used. These constituted 17.6% of all the unnatural deaths. From the available data the mortality rate from poisoning in Patiala district comes to 60 per million; whereas for males it is 81 per million and for females it is 35 per million. The mortality rate from poisoning in urban population is 78 per million whereas in rural population it is 50 per million. The results of the present study have been compared to those from India and around the world.

1. Introduction

Poisoning is a major epidemic of non-communicable disease in the present century. Among the unnatural deaths, deaths due to poisoning come next only to road traffic accident deaths. In earlier times, the poisoning deaths from pesticides were mainly accidental but easy availability, low cost and unrestricted sale have led to an increase in suicidal and homicidal cases as well. Pesticides which were invented to protect crops from rodents, insects; and humans from starvation have themselves become an important contributor to unnatural deaths. In the developed world, poisoning due to narcotics and drug over dosage is far more common than due to pesticides. World Health Organization (WHO) estimated 0.3 million people die every year due to various poisoning agents. The death rate due to poisoning is much higher in the low- and middle-income countries of Europe than in any other region of the world.[1]

2. Material and method

The present study was conducted in the mortuary of a state tertiary care and referral hospital from January to December 2010. This study comprised of hospital deaths and deaths in the jurisdiction of Patiala district alleged to have died due to poisoning. The data required was collected from the police inquest papers, relatives accompanying the deceased, autopsy and toxicological examination. The cases where chemical examination reports showed 'No poison detected' have not been included in the study. The data thus collected was then compared with various national as well as international studies.

2.1. Observations

A total of 624 post-mortems were conducted in the year 2010 out of which 110 were positive for poisoning on analysis, this constituted 17.6% of all the unnatural deaths. From Fig. 1, it is clear that maximum number of deaths due to poisoning are that males (80/110 i.e. 72.72%). The incidence is highest in the age group 21–30 years followed by the age group 31–40 years (Fig. 2). The age group 0–10 years is showing minimum number of cases. The incidence of poisoning cases was more in cases of rural background as compared to the urban (Fig. 3). Fig. 4 shows that the month of May records the highest number of cases followed by November while month of February records the least number of cases. The peak summer months and peak winter months are showing larger number of cases as compared to spring and autumn seasons. Aluminium

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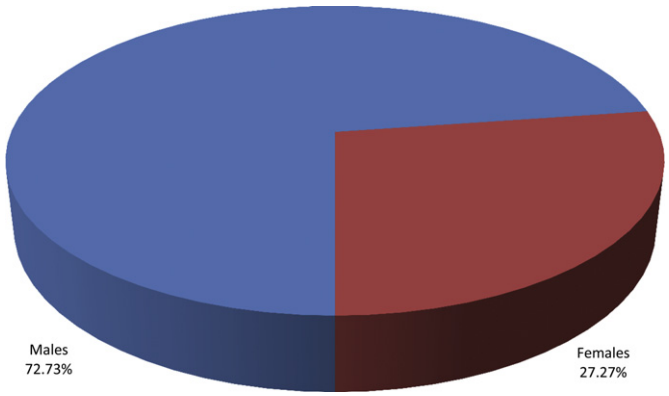

Fig. 1. Sex wise distribution of poisoning cases.

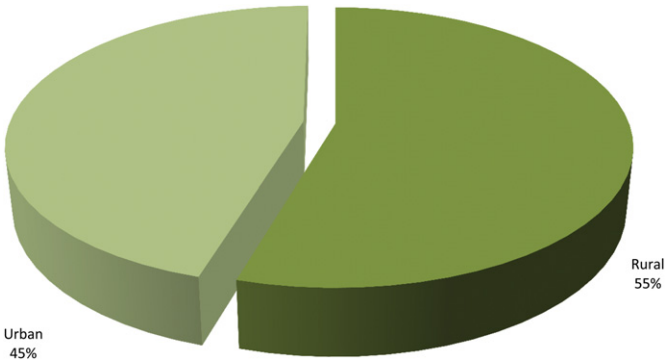

Fig. 3. Cases according to the area of residence.

phosphide is responsible for majority of cases to the extent of 50% while chloro-compounds and organo-phosphorus compounds, i.e. pesticides constituted the rest. While aluminium phosphide is the most common type of poison used in cases of both males and females, the least number of male deaths was due to chloro-compounds and in females the organo-phosphorus compounds were least commonly used. No other poison was reported in the toxicological analysis reports from the Chemical Examiner.

3. Discussion

During our study, 624 autopsies were performed in over the year 2010, out of which 110 cases had died of poisoning, thereby constituting 17.6% of the total medico legal autopsies. The countries showing percentage of poisoning autopsy cases to be around 10% out of total autopsies performed include Germany,[2] Korea,[3] Bangladesh,[4] Turkey[5] and China.[6] However, Greece,[7] West Indies[8] and South Africa[9] depict a picture of less than 3%. Most of the above mentioned countries are more developed as compared to India, so more stringent control over the use of pesticides and greater safety measures could possibly explain the differences.

In our study, 72.72% of the total cases were males and 27.27% were females (Fig. 1). There is strong convergence of findings within India and abroad of male preponderance. This could probably be explained by the more frequent involvement of males in dealing with poisonous substances (occupational hazard) and more prone to stress and thus more frequently affected. This study (Fig. 3) shows incidence of poisoning deaths in rural population to be 54.55% and in urban population to be 45.45%. A study from Iran[10] found urban population to be more affected. As per the latest national census data[11] the population of Patiala district is 1,844,934 with number of males as 987,390 and females as 857,544. The rural population is 1,200,244 ($M = 642,633$ and $F = 557,591$) and urban population is 644,710 ($M = 344,757$ and $F = 299,953$). The ratio of male and female as evident from the autopsy findings is 2.6:1 (80/30) while from the population data it is found to be 1.15:1. The ratio of rural and urban deaths is 1.2:1 (60/50) while from the population data the rural-urban ratio comes out to be 1.86:1. From the available data the mortality rate from poisoning in Patiala district comes to 60 per million; whereas for males it is 81 per million and for females it is 35 per million. The mortality rate from poisoning in urban population is 78 per million whereas in rural population it is 50 per million. These figures belie the common perception that, in our region, though most of the poisoning cases are from rural areas, but the population incidence is more in urban areas; a fact which none of the previous studies[12–15] have correlated. The study from Bulgaria showed an incidence of 49.9 per million.[16] The death rate in this region of the world is comparable to Australia,[17] Bulgaria,[16] USA[18,19] and Iran[10] but it is much higher in countries like Russia,[20] Poland,[21] Norway[22] and New Zealand.[23]

The present study shows that 41.82% of total cases belonged in the age group 21–30 years followed by 20% cases in the age group 31–40 years and 18.18% in the 11–20 years age group. The age group of 41–50 years had 12.73% victims but the 0–10 years age group had minimum number of cases (0.91%) followed by the age group 51–60 years which showed 1.82%. The global studies also show the victims are frequently affected in the most active periods

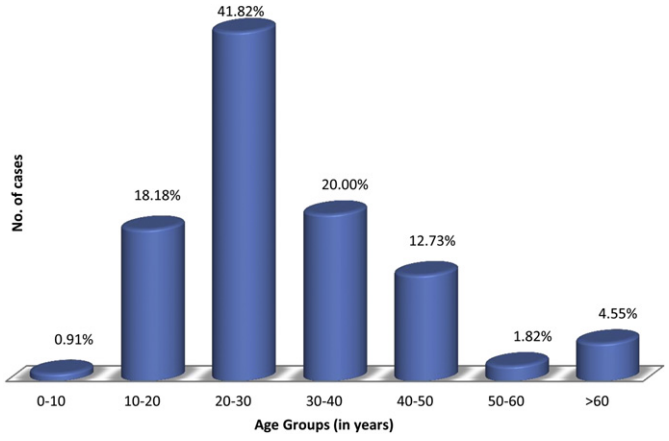

Fig. 2. Spread of poisoning cases across different age groups.

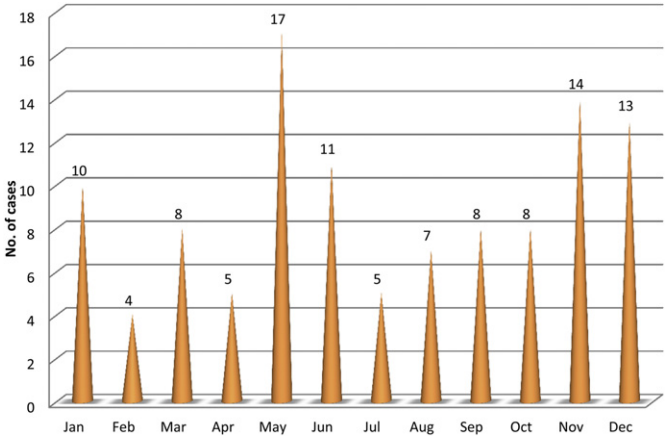

Fig. 4. Month wise distribution of the poisoning cases.

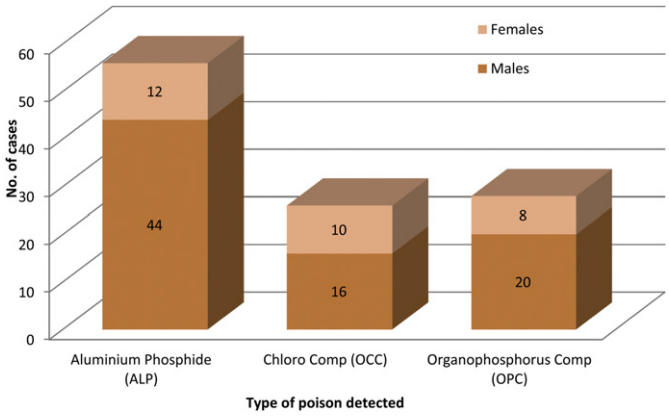

Fig. 5. Number of poisoning cases as per specific poison detected.

of their lives i.e. adult age. The victims in their extremes of ages were far less affected due to limited exposure to poisonous substances. Only significant deviation was observed in Korea[3] where maximum number of the victims was in the above 70 year age group.

Fig. 4 gives maximum number of the cases in the month of May (15.45%) and month of June had a 10% case load. The months of December and January show the incidence to be at 11.82% and 9.09% respectively indicating that poisoning was more in the peak summer season as compared to the peak winter season. Available data from studies done in foreign countries is also indicating increased frequency in warmer or summer months.

Our study shows (Fig. 5) that maximum number of poisoning deaths was due to aluminium phosphide poisoning i.e. 50.9% followed by Chloro-compounds 23.64% and organo-phosphorus compounds 25.45%. The findings of only three types of poison (aluminium phosphide, organo-chlorides, and organo-phosphorus compounds) in the present study could possibly be explained by the fact that either the concerned chemical examination laboratory is not examining the viscera for other poisons or the population in this region of the country is being affected by a limited variety of poisons because of easy access. The studies done in various developed countries are showing that deaths are more frequently with pharmaceutical drugs like narcotic opioids and carbon monoxide as evident, China,[24] USA,[18] New Zealand,[23] Turkey[5] and Norway.[22] The Asian studies (Turkey,[25] Korea,[3] Jordan[26] and China[6]) have demonstrated that a greater number of people are affected with agriculture related poisons as these countries are agro dominant. Bulgaria[16] and Uganda[27] have shown the highest number of deaths due to alcohol. The differences might be attributed to the fact that India is still a developing country with an agriculture based economy. The developed countries are heavily industrialised and exposure of their population to agriculture related substances is thus minimal. The deaths in these countries are more commonly due to narcotics and drug over dosage and carbon monoxide exposure. Increased emissions from industries, automobiles are associated with greater carbon monoxide levels (Fig. 6) (Table 1).

Fig. 6. World map showing countries represented in this study.

Table 1
Comparison of various poisoning profiles around the world.

No.	Study	Year of study	Sex	Age (in yrs)	Location	Incidence	Month	Poison (most common)
1	Iran[10]	1995	Male 65.5%	–	–	0.29 per 10000	Summer	Drugs 27% Pesticides 24%
2	Switzerland[24]	1996	Male 71%	20–39, 43%	–	30.4% of autopsies	–	Narcotics 55.7% Intoxicants 25%
3	India, Faridkot[12]	1996	Male 75.5%	21–30 46.56%	Rural 66.4%	–	Summer 60.32%	OPC 27.48%
4	Bangladesh[4]	1997	Male 54.6%	13–24 48.4%	Urban 60.8%	10.8% of autopsies	–	OCC 51.6% OPC 37.7%
5	Bulgaria[16]	1998	Male, 73.1%	–	–	0.49 per 10000	–	Males-Alcohol 30.1%, Females-Drugs 33.7%
6	West Indies[8]	1999	Male 59.1%	20–29 22.7%	–	1% of autopsies	–	Pesticides 41% Drugs 27%
7	India, Chandigarh[13]	1999	Male	15–25 48.5%	Rural	17.4% of autopsies	–	ALP 38.9% Alcohol 8.4% OPC 6.9%
8	Russia[20]	1999	–	–	–	4.5 per 10000	–	Alcohol 62.2% CO 15.4% Acetic acid 6.3%
9	Germany[2]	2000	Male	Male 39 Female 46	–	11.5% of autopsies	–	CO 49% Alcohol 21% Drugs 19%
10	Pakistan[28]	2000	Male 63%	10–30 90%	–	–	–	Pesticides 64%
11	India, Orissa[29]	2001	Male 53.3%	21–30, 40.5%	Rural 58.2%	–	Summer 31.7%	OPC 22.9%
12	Turkey[25]	2001	Female 55%	<30 50%	–	–	–	Pesticides 21.1%
13	USA, Oklahoma[18]	2001	Male 67%	35–44 33.76%	–	0.22 per 10000	–	Narcotic analgesics 74% Antianxiety drugs 19% Tricyclic antidepressants 14%
14	USA[18]	2001	Male 73.6%	35–44	–	0.46 per 10000	Warmer months	Carbon Monoxide
15	Korea[3]	2001	Male 65%	–	–	11.58% of autopsies	Summer	Pesticides 50.9%
16	Jordan[26]	2002	Male 50.7%	20–29, 49.3%	–	0.068 per 10000	–	Carbamates 78.6% OPC 16.4%
17	New Zealand[23]	2002	Male 68.9%	25–44, 11.1%	–	6.3 per 100000	–	Carbon Monoxide 64.3%
18	USA, New Jersey[19]	2003	Male 74%	25–44 52.7%	–	0.79 per 10000	–	Cocaine 37.7% Alcohol 36.4% Heroin 34.9% Morphine 29.3%
19	Poland[21]	2003	Male 76.9%	–	–	65.7 per 10000	–	Ethanol 46.2% Pharmaceuticals 25% CO 6.2%
20	Turkey[5]	2003	Male 73.2%	40-49 20.3%	–	9.8% of autopsies	CO -winter, Insecticides-summer	CO 43.5%, Insecticides 24.6% Alcohol 18.4%
21	Greece[7]	2004	Male 76.1%	Mean 46	Rural 67%	2.9% of autopsies	–	Substance abuse 47.8%, Pesticides 19.6%
22	Norway[22]	2004	Male 67%	Mean 44	–	2.4 per 10000	–	Opioids 66% Ethanol 9%
23	India, Punjab[14]	2005	Male 76.4%	21–30 35%	–	–	–	OCC 42.8% ALP 32.6%
24	South Africa[9]	2005	Male 66%	11–30 51.5%	–	1.6% of autopsies	–	Traditional medicines 51.7%
25	Uganda[27]	2005	Male 75%	>30	–	–	–	Household chemicals (50%), CO (25%), Agrochemicals (25%)
26	Japan[30]	2006	–	–	–	–	–	Ethanol 11.48% CO 10.54%
27	Australia[17]	2008	Male 70%	–	–	~5 per 100000	–	Narcotics 17.9% Alcohol 4.7%
28	China[6]	2008	Male 63.2%	21–40, > 50%	–	8.8% of autopsies	–	Pesticides 38.7% Carbon Monoxide 17% Drugs 16%
29	India, Rohtak[15]	2009	Male 67.3%	21–30 34.8%	Rural 73.2%	23.4% of autopsies	June 21%	ALP 64%
30	Brazil[31]	2009	Male 68.8%	40–49 20.8%	–	–	–	Pesticides 42.1%
31	Present study (India, Patiala)	2010	Male 72.72%	21–30, 41.82%	Rural 54.55%	17.6% of autopsies	May 15.45%	ALP 50.9%, OPC 25.45% OCC 23.64%

Abbreviations: ALP = Aluminium Phosphide, OCC = Organo Chloro compound, OPC = Organo Phosphorus compound, CO = Carbon Monoxide.

4. Conclusion

Poisoning is a problem of the society which should be considered seriously from all aspects. The present study has demonstrated this fact once again. The incidence of poisoning is rising and further likely to rise more in the future because of the uncontrolled growth of human population and ours being an agro based economy. Contributing to the above problem is the easy availability of aluminum phosphide which has been found as the most common culprit along with the non-availability of specific antidote. This calls for urgent research to find a specific antidote and strict legislative measures over the sale of the fumigant. This is also applicable to all other common drugs and poisons responsible for poisoning cases. Perhaps, the most effective step would be to educate the people of the seriousness of the problem though health education and finding ways to lead a healthy and stress free lifestyle.

The developed countries like USA, New Zealand, Switzerland, Germany, Norway etc. should formulate strategies to limit the access of the general population to narcotics and the physicians should not over prescribe medicines to their patients so that incidence of poisoning cases could be brought down.

Conflict of interest
None.

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Ethical approval
None.

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